```
Set     Items   Description
S1       2890   IPP OR (ISOPENTYL PYROPHOSPHATE)
S2         32   S1 AND (ARABIDOPSIS OR THALIANA OR HAEMATOCOCCUS OR PLUVIA-
               LIS OR PHAFFIA OR RHODOZYMA)
S3         14   RD (unique items)
?t s3/3,ab/all
>>>No matching display code(s) found in file(s): 60, 65
```

3/3,AB/1 (Item 1 from file: 155)

DIALOG(R)File 155:MEDLINE(R)

09722033 98409684

Differential expression of two isopentenyl pyrophosphate isomerases and enhanced carotenoid accumulation in a unicellular chlorophyte.

Sun Z; Cunningham FX Jr; Gantt E

Department of Cell Biology and Molecular Genetics, University of Maryland, College Park, MD 20742, USA.

Proc Natl Acad Sci U S A (UNITED STATES) Sep 15 1998, 95 (19) p11482-8, ISSN 0027-8424 Journal Code: PV3

Languages: ENGLISH

Document type: JOURNAL ARTICLE

The enzyme isopentenyl pyrophosphate (**IPP**) isomerase catalyzes the reversible isomerization of **IPP** to produce dimethylallyl pyrophosphate, the initial substrate leading to the biosynthesis of carotenoids and many other long-chain isoprenoids. Expression of **IPP** isomerase, and of two enzymes specific to the carotenoid pathway (lycopene beta-cyclase and beta-carotene-C-4-oxygenase), was followed in the green unicellular alga **Haematococcus pluvialis** after exposure to high illumination. This alga uniquely accumulates carotenoids in the cytoplasm and in late developmental stages turns deep-red in color because of accumulation of ketocarotenoids in the cytosol. The carotenoid/chlorophyll ratio increased 3-fold in wild type and 6-fold in a precocious carotenoid-accumulating mutant (Car-3) within 24 h after increasing the illumination from 20 to 150 &mgr;mol photon m-2.s-1. Two cDNAs encoding **IPP** isomerase in **Haematococcus** , ipiHp1 and ipiHp2, were identified. Although otherwise highly similar (95% identity overall), the predicted sequence of ipiHp1 contained a 12-aa region not found in that of ipiHp2. This was reflected by a size difference between two polypeptides of 34 and 32.5 kDa, both of which reacted with an antibody to the product of ipiHp1. We suggest that the 32.5-kDa form is involved with the carotenoid accumulation in the cytoplasm, since the 32.5-kDa polypeptide was preferentially up-regulated by high light preceding the carotenoid increase and only this form was detected in red cysts.

3/3,AB/2 (Item 2 from file: 155)

DIALOG(R)File 155:MEDLINE(R)

09435475 98145438

Analysis of the isopentenyl diphosphate isomerase gene family from Arabidopsis thaliana.

Campbell M; Hahn FM; Poulter CD; Leustek T

Division of Science, Pennsylvania State University-Erie, Behrend College, PA 16563, USA.

Plant Mol Biol (NETHERLANDS) Jan 1998, 36 (2) p323-8, ISSN 0167-4412 Journal Code: A6O

Contract/Grant No.: GM 25521, GM, NIGMS

Languages: ENGLISH

Document type: JOURNAL ARTICLE

Two **Arabidopsis thaliana** cDNAs (IPP1 and IPP2) encoding isopentenyl diphosphate isomerase (**IPP** isomerase) were isolated by complementation of an **IPP** isomerase mutant strain of Saccharomyces cerevisiae. Both cDNAs encode enzymes with an amino terminus that may function as a transit peptide for localization in plastids. At least 31 amino acids from the amino terminus of the IPP1 protein and 56 amino acids from the amino terminus of the IPP2 protein are not essential for enzymatic activity.

Genomic DNA blot analysis confirmed that IPP1 and IPP2 are derived from a small gene family in A. **thaliana** . Based on northern analysis expression of both cDNAs occurs predominantly in roots of mature A. **thaliana** plants grown to the pre-flowering stage.

3/3,AB/3 (Item 3 from file: 155)
DIALOG(R)File 155:MEDLINE(R)

09069690 97307851
Expression of an exogenous isopentenyl diphosphate isomerase gene enhances isoprenoid biosynthesis in Escherichia coli.
Kajiwara S; Fraser PD; Kondo K; Misawa N
Central Laboratories for Key Technology, Kirin Brewery Co. Ltd., 1-13-5, Fukuura, Kanazawa-ku, Yokohama-shi, Kanagawa 236, Japan.
Biochem J (ENGLAND) Jun 1 1997, 324 (Pt 2) p421-6, ISSN 0264-6021 Journal Code: 9YO
Languages: ENGLISH
Document type: JOURNAL ARTICLE
Escherichia coli expressing the Erwinia carotenoid biosynthesis genes, crtE, crtB, crtI and crtY, form yellow-coloured colonies due to the presence of beta-carotene. This host was used as a visible marker for evaluating regulatory systems operating in isoprenoid biosynthesis of E. coli. cDNAs enhancing carotenoid levels were isolated from the yeast **Phaffia rhodozyma** and the green alga **Haematococcus pluvialis** . Nucleotide sequence analysis indicated that they coded for proteins similar to isopentenyl diphosphate (**IPP**) isomerase of the yeast Saccharomyces cerevisiae. Determination of enzymic activity confirmed the identity of the gene products as **IPP** isomerases. The corresponding gene was isolated from the genomic library of S. cerevisiae based on its nucleotide sequence, and was confirmed to have the same effect as the above two **IPP** isomerase genes when introduced into the E. coli transformant accumulating beta-carotene. In the three E. coli strains carrying the individual exogenous **IPP** isomerase genes, the increases in carotenoid levels are comparable to the increases in **IPP** isomerase enzyme activity with reference to control strains possessing the endogenous gene alone. These results imply that **IPP** isomerase forms an influential step in isoprenoid biosynthesis of the prokaryote E. coli, with potential for the efficient production of industrially useful isoprenoids by metabolic engineering.

3/3,AB/4 (Item 4 from file: 155)
DIALOG(R)File 155:MEDLINE(R)

08723308 96205971
Arabidopsis thaliana **contains two differentially expressed farnesyl-diphosphate synthase genes.**
Cunillera N; Arro M; Delourme D; Karst F; Boronat A; Ferrer A
Unitat de Bioquimica, Facultat de Farmacia, Universitat de Barcelona, Spain.
J Biol Chem (UNITED STATES) Mar 29 1996, 271 (13) p7774-80, ISSN 0021-9258 Journal Code: HIV
Languages: ENGLISH
Document type: JOURNAL ARTICLE
The enzyme farnesyl-diphosphate synthase (FPS; EC 2.5.1.1/EC 2.5.1.10) catalyzes the synthesis of farnesyl diphosphate (FPP) from isopentenyl diphosphate (**IPP**) and dimethylallyl diphosphate (DMAPP). This reaction is considered to be a rate-limiting step in isoprenoid biosynthesis. Southern blot analysis indicates that **Arabidopsis thaliana** contains at least 2 genes (FPS1 and FPS2) encoding FPS. The FPS1 and FPS2 genes have been cloned and characterized. The two genes have a very similar organization with regard to intron positions and exon sizes and share a high level of sequence similarity, not only in the coding region but also in the intronic sequences. Northern blot analysis showed that FPS1 and FPS2 have a different pattern of expression. FPS1 mRNA accumulates preferentially in roots and inflorescences, whereas FPS2 mRNA is predominantly expressed in

inflorescences. The cDNA corresponding to the FPS1 gene was isolated by functional complementation of a mutant yeast strain defective in FPS activity (Delourme, D., Lacroute, F., and Karst, F. (1994) Plant Mol. Biol. 26, 1867-1873). By using a reverse transcription-polymerase chain reaction strategy we have cloned the cDNA corresponding to the FPS2 gene. Analysis of the FPS2 cDNA sequence revealed an open reading frame encoding a protein of 342 amino acid residues with a predicted molecular mass of 39,825 Da. FPS1 and FPS2 isoforms share an overall amino acid identity of 90.6%. **Arabidopsis** FPS2 was able to rescue the lethal phenotype of an ERG20-disrupted yeast strain. We demonstrate that FPS2 catalyzes the two successive condensations of **IPP** with both DMAPP and geranyl diphosphate leading to FPP. The significance of the occurrence of different FPS isoforms in plants is discussed in the context of the complex organization of the plant isoprenoid pathway.

3/3,AB/5 (Item 5 from file: 155)
DIALOG(R)File 155:MEDLINE(R)

08720996 96146506
Open reading frame 176 in the photosynthesis gene cluster of Rhodobacter capsulatus encodes idi, a gene for isopentenyl diphosphate isomerase.
Hahn FM; Baker JA; Poulter CD
Department of Chemistry, University of Utah, Salt Lake City 84112, USA.
J Bacteriol (UNITED STATES) Feb 1996, 178 (3) p619-24, ISSN 0021-9193
Journal Code: HH3
Contract/Grant No.: GM 25521, GM, NIGMS
Languages: ENGLISH
Document type: JOURNAL ARTICLE
Isopentenyl diphosphate (**IPP**) isomerase catalyzes an essential activation step in the isoprenoid biosynthetic pathway. A database search based on probes from the highly conserved regions in three eukaryotic **IPP** isomerases revealed substantial similarity with ORF176 in the photosynthesis gene cluster in Rhodobacter capsulatus. The open reading frame was cloned into an Escherichia coli expression vector. The encoded 20-kDa protein, which was purified in two steps by ion exchange and hydrophobic interaction chromatography, catalyzed the interconversion of **IPP** and dimethylallyl diphosphate. Thus, the photosynthesis gene cluster encodes all of the enzymes required to incorporate **IPP** into the ultimate carotenoid and bacteriochlorophyll metabolites in R. capsulatus. More recent searches uncovered additional putative open reading frames for **IPP** isomerase in seed-bearing plants (Oryza sativa, Arabadopsis **thaliana** , and Clarkia breweri), a worm (Caenorhabiditis elegans), and another eubacterium (Escherichia coli). The R. capsulatus enzyme is the smallest of the **IPP** isomerases to be identified thus far and may consist mostly of a fundamental catalytic core for the enzyme.

3/3,AB/6 (Item 1 from file: 34)
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

05986622 Genuine Article#: XM342 Number of References: 27
Title: Cloning and subcellular localization of hamster and rat Isopentenyl diphosphate dimethylallyl diphosphate isomerase - A PTS1 motif targets the enzyme to peroxisomes
Author(s): Paton VG; Shackelford JE; Krisans SK (REPRINT)
Corporate Source: SAN DIEGO STATE UNIV,DEPT BIOL/SAN DIEGO//CA/92182 (REPRINT); SAN DIEGO STATE UNIV,DEPT BIOL/SAN DIEGO//CA/92182
Journal: JOURNAL OF BIOLOGICAL CHEMISTRY, 1997, V272, N30 (JUL 25), P 18945-18950
ISSN: 0021-9258 Publication date: 19970725
Publisher: AMER SOC BIOCHEMISTRY MOLECULAR BIOLOGY INC, 9650 ROCKVILLE PIKE, BETHESDA, MD 20814
Language: English Document Type: ARTICLE
Abstract: To date, isopentenyl diphosphate:dimethylallyl diphosphate isomerase (**IPP** isomerase; EC 5.3.3.2) is presumed to have a cytosolic

localization, However, we have recently shown that in permeabilized cells lacking cytosolic components, mevalonate can be converted to cholesterol, implying that all of the enzymes required for the conversion of mevalonate to farnesyl diphosphate are found in the peroxisome. To provide unequivocal evidence for the subcellular localization of **IPP** isomerase, in this study, we have cloned the rat and hamster homologues of **IPP** isomerase and identified the signal that targets this enzyme to peroxisomes. In addition, we also demonstrate that **IPP** isomerase is regulated at the mRNA level.

3/3,AB/7 (Item 2 from file: 34)
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

05717515 Genuine Article#: WT155 Number of References: 23
Title: Effects of random mutagenesis in a putative substrate-binding domain of geranylgeranyl diphosphate synthase upon intermediate formation and substrate specificity
Author(s): Ohnuma S (REPRINT) ; Hemmi H; Ohto C; Nakane H; Nishino T
Corporate Source: TOHOKU UNIV,DEPT BIOCHEM & ENGN, AOBA KU/SENDAI/MIYAGI 98077/JAPAN/ (REPRINT); TOYOTA MOTOR CO LTD,BIO RES LAB/TOYOTA 47171//JAPAN/
Journal: JOURNAL OF BIOCHEMISTRY, 1997, V121, N4 (APR), P696-704
ISSN: 0021-924X Publication date: 19970400
Publisher: JAPANESE BIOCHEMICAL SOC, ISHIKAWA BLDG-3F, 25-16 HONGO-5-CHOME, BUNKYO-KU, TOKYO 113, JAPAN
Language: English Document Type: ARTICLE
Abstract: Archaeal geranylgeranyl diphosphate (GGPP) synthase catalyzes the consecutive condensation of isopentenyl diphosphate (**IPP**) with allylic diphosphates to produce GGPP with significant amounts of intermediates, To obtain information about the amino acids involved in the condensation and the release of intermediates, we randomly mutagenized two proximal regions, I and II, of the Sulfolobus acidocaldarius GGPP synthase gene and created two degenerate libraries, I and II, respectively, Regions I and II correspond to amino acid residues 170-173 and 166-168, respectively, The prenyltransferase activities of about 200 clones were analyzed using the in vivo red-white system and the conventional in vitro assay, Although, in library I, no mutated enzymes that failed to catalyze the formation of GGPP were found, as assayed with the red-white system, almost all the mutated enzymes exhibited weak GGPP synthesis activity, and many produced large amounts of intermediates, The formation ofintermediates increased as the concentration of **IPP** was decreased or as the concentration of the allylic substrate was increased, These phenomena can be regarded as a reflection of the increased Km for **IPP** and the decreased affinity for products including intermediates, On the other hand, no mutants from library II showed such changes, These results suggest that the region from 170 to 173 is concerned in the recognition of both **IPP** and allylic diphosphates, and that the change in responsiveness to prenyl diphosphates causes a change in intermediate formation.

3/3,AB/8 (Item 3 from file: 34)
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

05527078 Genuine Article#: WE548 Number of References: 33
Title: Promoter-independent cold-shock induction of cspA and its derepression at 37 degrees C by mRNA stabilization
Author(s): Fang L; Jiang WN; Bae WH; Inouye M (REPRINT)
Corporate Source: UNIV MED & DENT NEW JERSEY,ROBERT WOOD JOHNSON MED SCH, DEPT BIOCHEM, 675 HOES LANE/PISCATAWAY//NJ/08854 (REPRINT); UNIV MED & DENT NEW JERSEY,ROBERT WOOD JOHNSON MED SCH, DEPT BIOCHEM/PISCATAWAY//NJ/08854
Journal: MOLECULAR MICROBIOLOGY, 1997, V23, N2 (JAN), P355-364
ISSN: 0950-382X Publication date: 19970100

Publisher: BLACKWELL SCIENCE LTD, OSNEY MEAD, OXFORD, OXON, ENGLAND OX2 0EL
Language: English Document Type: ARTICLE
Abstract: The gene for CspA, the major cold-shock protein of Escherichia coli is known to be dramatically induced upon temperature downshift. Here, we report that three-base substitutions around the Shine-Dalgarno sequence in the 159-base 5'-untranslated region of the cspA mRNA stabilizes the mRNA 150-fold, resulting in constitutive expression of cspA at 37 degrees C. This stabilization was found to be at least partially due to resistance against RNase E degradation. The cold-shock induction of cspA was also achieved by exchanging its promoter with the non-cold-shock **Ipp** promoter. The results presentedindicate that the cspA gene is efficiently transcribed even at 37 degrees C. However, the translation of the cspA mRNA is blocked because of its extreme instability at 37 degrees C. The presented results also demonstrate that the cspA gene is constitutively transcribed at all temperatures; however,its expression at 37 degrees C is prevented by destabilizing its mRNA.

3/3,AB/9 (Item 1 from file: 60)
DIALOG(R)File 60:CRIS/USDA

09159971
PROJ NO: MD-J-160 AGENCY : CSRS MD.
PROJ TYPE: HATCH
START: 14 OCT 92 TERM: 30 JUN 97 FY: 1997
INVEST: GANTT E
PLANT BIOLOGY
UNIV OF MARYLAND
COLLEGE PARK MARYLAND 20742

THE CAROTENOID PATHWAY IN PLANTS: IDENTIFICATION OF GENES AND ENHANCEMENT FOR AQUACULTURE

OBJECTIVES:Major goals are to identify and sequence genes encoding enzymes of the carotenoid pathway, and to determine optimal conditions for synthesis of carotenoids important for aquaculture and in fruits and vegetables.

PRIMARY HEADINGS: R318 Noncommodity Biotechnology, Biometry; A4900 Biology of Plants and Animals;C6600 Microorganisms, Viruses, etc.;F0312 Biology-Molecular-Plant

3/3,AB/10 (Item 1 from file: 71)
DIALOG(R)File 71:ELSEVIER BIOBASE

00815301 1998057398
Analysis of the isopentenyl disphosphate isomerase gene from Arabidopsis thaliana
Campbell M.; Hahn F.M.; Poulter C.D.; Leustek T.
ADDRESS: M. Campbell, Division of Science, Pennsylvania State University-Erie, Behrend College, Erie, PA 16563, United States
Journal: Plant Molecular Biology, 36/2 (323-328), 1998, Netherlands
PUBLICATION DATE: 19980000
CODEN: PMBID
ISSN: 0167-4412
DOCUMENT TYPE: Article
LANGUAGES: English SUMMARY LANGUAGES: English
NO. OF REFERENCES: 25

Two **Arabidopsis thaliana** cDNAs (IPP1 and IPP2) encoding isopentenyl diphosphate isomerase (**IPP** isomerase) were isolated by complementation of an **IPP** isomerase mutant strain of Saccharomyces cerevisiae. Both cDNAs encode enzymes with an amino terminus that may function as a transit peptide for localization in plastids. At least 31 amino acids from the

13061905 PASCAL No.: 97-0352290
Contribution a l'etude de la regulation de la biosynthese des carotenoides chez le poivron (Capsicum annuum L.): isolement du gene GGPPS, clonage et caracterisation des ADNc codants pour les enzymes IPP -isomerase et Lycopene beta-cyclase
(A contribution to the study if the regulation of the carotenoids biosynthetic pathway in bell pepper (Capsicum annuum L.): Isolation of the GGPPS gene, cloning and characterisation of the cDNA CODING FOR THE ENZYMES IPP-isomerase and lycopene beta-cyclase)
BADILLO-UJUETA Alfredo; WEIL J H, dir
Universite de Strasbourg 1, Strasbourg, Francee
Univ.: Universite de Strasbourg 1. Strasbourg. FRA Degree: Th. doct. 1996-12; 1996 112 p.
Language: French Summary Language: French; English

Dans certains fruits comme le fruit de poivron, les chromoplastes sont le resultat de la profonde transformation de chloroplastes preexistant lors du processus de murissement des fruits. Le changement le plus remarquable est la synthese et l'accumulation de nouveaux carotenoides, differents de ceux presents dans les tissus verts. Tous ces evenements impliquent une regulation complexe de l'expression des genes durant le developpement de la plante. Nous avons clone et caracterise deux ADNc codant pour des enzymes de la voie de biosynthese des carotenoides, la lycopene B-cyclase et l'isopentenyl diphosphate isomerase (**IPP** -isomerase). Egalement, nous avons isole un clone genomique codant pour l'enzyme geranylgeranyl pyrophosphate synthase (GGPPS) dont la fonctionnalite a ete demontree par des experiences d'expression transitoire. Nous avons trouve qu'une enzyme en avale dans la voie de biosynthese, la capsanthine-capsorubine synthase (CCS), laquelle est fortement induite durant le stade rouge du developpement du fruit, a une capacite catalytique double: une activite violaxanthine et antheraxanthine de-epoxydase additionne d'un niveau significatif d'activite B-cyclase. Nous avons propose que, dans le fruit de poivron, l'induction de la transcription du gene CCS serait la cause principale de la deviation du flux des intermediaires vers la synthese et l'accumulation des carotenoides du type B presents dans les chromoplastes des fruits rouges. L'expression des genes **IPP** -isomerase chez **Arabidopsis** ne semble pas etre affectee par le traitement avec l'herbicide norflurazon, un inhibiteur de la synthese des carotenoides. Sur ce point, le gene **IPP** -isomerase differe des autres genes de la voie de synthese des carotenoides lesquels sont induits dans de telles conditions. De facon similaire, le niveau de transcrit **IPP** -isomerase ne semble pas augmenter de maniere importante dans le fruit de poivron lors du processus de murissement. Ces resultats peuvent refleter le fait que le substrat et le produit de cette enzyme sont egalement utilises dans la biosynthese d'autres terpenoides distinct des carotenoides

3/3,AB/14 (Item 1 from file: 357)
DIALOG(R)File 357:Derwent Biotechnology Abs

0218242 DBA Accession No.: 97-13363 PATENT
Eukaryotic carotenoid biosynthetic enzymes and related genes- epsilon-cyclase, isopentenyl-pyrophosphate-isomerase and beta-carotene-hydroxylase gene expression in e.g. Escherichia coli for carotenoid production
AUTHOR: Cunningham Jr F X; Sun Z
CORPORATE SOURCE: College Park, MD, USA.
PATENT ASSIGNEE: Univ.Maryland 1997
PATENT NUMBER: WO 9736998 PATENT DATE: 971009 WPI ACCESSION NO.: 97-503091 (9746)
PRIORITY APPLIC. NO.: US 624125 APPLIC. DATE: 960329
NATIONAL APPLIC. NO.: WO 97US540 APPLIC. DATE: 970128
LANGUAGE: English
ABSTRACT: Isolated eukaryotic enzymes having the 524 (**Arabidopsis**

thaliana epsilon-cyclase), 294 (A. **thaliana** beta-carotene-hydroxyla se), 305 or 293 (**Haematococcus pluvialis** isopentenyl-pyrophosphate (**IPP**)-isomerase) and 284 or 261 (A. **thaliana** **IPP** -isomerase) amino acid protein sequences (specified) are new. Also claimed are: an isolated DNA sequence, preferably having the 1,860, 954, 996, 1,165, 1,135 or 956 bp DNA sequence (specified), encoding the 294, 305, 293, 284, 261 or 294 residue sequences; an expression vector, preferably plasmid pATeps, plasmid pHP05, plasmid pMDP1, plasmid pATDP7, plasmid pHP04 or plasmid pAT0HB (ATCC 98005, 98000, 98001, 98002, 98004 or 98003), containing the DNA sequence; a host cell (e.g. Escherichia coli) containing the expression vector; and a DNA sequence which results in the expression of a eukaryotic carotenoid biosynthetic enzyme. The following methods are also claimed: screening for eukaryotic genes involved in carotenoid biosynthesis, metabolism or degradation; producing a carotenoid; inhibiting carotenoid synthesis in a host; increasing the production of a secondary metabolite of **IPP** -isomerase by a host. (89pp)

?ds

Set	Items	Description
S1	2890	IPP OR (ISOPENTYL PYROPHOSPHATE)
S2	32	S1 AND (ARABIDOPSIS OR THALIANA OR HAEMATOCOCCUS OR PLUVIALIS OR PHAFFIA OR RHODOZYMA)
S3	14	RD (unique items)

?

US 087373190EP1

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Team: OIPEBackFileIndexing
Dossier: 08737319

Legal Date: 08-17-1998

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4	NFDR	1

Total number of pages: 14

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